G. R. S. IX-5]

Previous references. DR 1892 Secn-1-2 191 (Municipal)

File No. 2 9/1892

Serial Nos. 1 - 2

Later references.

GENERAL AND REVENUE SECRETARIAT.

Serial Nos.

Part B for June 1893.

SUBJECT.

Col: Vibart's Scheme of Hesaraghatta water Supply to Bangalore.

Index

W D 88—GPB—50,000—24-7-16

Misc 2-92-1

DMW

Please see the Enclosed
Copy of the Madras Mail
in which is published a
letter from Col. Vibart. Regarding
his proposal of the Hospital
Scheme in 1887. See also
para 52 of
Mr. Scaldwell in his report
of 10 Jany 93 refers to
Col Vibarts' report of 20 Dec
1887, but does not refer to
that gentleman's Subsequent
reports of 11 Nov 87 & 27
April '88, from which Extracts
are published in the
Madras Mail. Why was
this Omission? Have
you seen or Mr Scaldwell
seen the subsequent reports
I have not seen them &
would like you to get the
same me Copies. If they
are not in our Office apply

Possibly they may be in
the Compilation "Memorandum
on the Bangalore Water
Supply" to which Mr
Caldwell refers in his
para. 52 - A careful
search should be made
for them there as well as Shenkere.

~~[illegible]~~

It is interesting that
Col. Vibart proposed
Hessaraghatta 5 years ago.
It only proves that Hessaraghatta
as the proper source of Supply
for Bangalore is bound
to impress any one who
intelligently studies the
Neighbourhood of Bangalore for
the purpose of a Supply water Supply
I wd. much like to see
if Col. Vibart proposed any
thing which we can properly now
adopt in carrying out
the Scheme in question —

H. Scott Gordon

17/5/13

E BANGALORE WATER SUPPLY.

olonel H. M. Vibart, R. E., writes as fol-
s from London :—

have observed with considerable interest
ing the last month that the Dewan of
sore has taken up the Hessargatta Project
the supply of water to Bangalore. I have
l several papers in your journal "from a
espondent" which seem penned to give the
ire credit of the proposal to the Dewan,
although my name is casually mention-
it is merely to show that the scheme I
posed has been abandoned, and that "the
wan seems to have perceived that the
argatta Tank, which is the terminal
on the Arkavati, already forms a dam
oss it and being 'terminal' receives and
trols, the entire catchment of the Arka-
a Valley." I am very glad to hear that the
wan has taken the matter up, because I have
ught for five years past that the Arkavati
er offered a highly satisfactory solution to
water difficulties of Bangalore. But I think I
y fairly claim to have been the one who first
ggested the scheme, and I should imagine the
wan would be the last person to wish to have
ributed to him the original idea although
has been far-sighted enough to see that the
eme is one well worthy of support and fur-
er consideration. During the years 1887-88
paid a great deal of attention to the subject
the water-supply of Bangalore, and on the
h November, 1887, I sent in a long Report
various sources of supply mentioning the

akavati at Sasavegutta and strongly re-
mmended its investigation. In this Report I
ated that I intended to have levels taken of
e Arkavati shortly, and I also mentioned a
itable place for a standpipe near Sasavegutta
the East, on a hill rising to 3,108 feet (this is
e Banawar Hill which is now proposed as a
itable site for a standpipe). On 27th April,
88, I forwarded another letter in continuation
my letter of 11th November, 1887. Having
w obtained proper levels of the Arkavati
proposed the fine Hesaragatta tank as a
rce of supply, and having sketched out my
eme, recommended that the Executive
gineer should be called upon to prepare
tailed plans and estimates in accordance
erewith. For some reason, best known to
mself, the Chief Engineer (Colonel Hasted)
ok no steps to carry out my proposal, nor did
visit the tank when he came up to Bangalore.
sent my papers to Sir Harry Prendergast,
.C.B., then Resident of Mysore, and that dis-
nguished officer, in company with the late
mented Major Kensington, R.E, visited the
nk. Both officers were extremely pleased with
ie scheme, although they thought it would
rove too costly. I enclose a copy of my Report
n the subject. This letter and enclosure will
tisfy you that the proposal which the Dewan
now anxious to carry out was originally pro-
osed by me more than five years ago,
nd I trust you will write something
your valuable journal in justification of my
laim to being the original proposer of the
heme now being taken up by the Dewan in
uch an able and far-sighted manner.

Extract from Report, 11th November, 1887.

It now remains to be seen what source can be
tilised if we go further away from Bangalore
think that the Arkavati River to the West of
Bangalore would do well. On the road to Nel-
mungalum, the same river is crossed some 12
miles from Bangalore, and at this point the drain-
age amounts to some 33,689 miles. I have examin-
ed this river for several miles above this point
and I think a suitable position for a bank across
this river will be found about ¾ of a mile south
of the Railway Bridge over the Arkavati (11½ miles
on the Mysore State Railway in the direction of
Tumkur). I intend to have levels taken of this river
shortly and propose to employ Supervisor Ser-
geant Green on this work. The water from this
river will have to be pumped up *fully 200 feet.* No
far off to the east are some hills Banawar Hill
(rising to 3,108ft.) which would be available on which
to place a stand pipe. The distance of Sasavegutta
(where the bund is proposed) to Subedar's Chuttrum
in a direct line is about 7 miles. . . .

In conclusion I would strongly recommend that
any proposal to supply Bangalore from the Arkavati
at Sasavegutta may be investigated, and if that
scheme should be found not sufficiently economical
—that water should be pumped from the Heranhalli
Tank. I think the former would be by far the best
of the two—but the latter would be superior to the
Agram Tank Scheme and less expensive, as very
little would have to be paid for compensation.

Extract from letter of 27th April, 1888.

In addition to the above, I have had levels taken
along the Arkavati River from the point where the
road from Bangalore to Nellamungalum crosses
up the river for a distance of over 7 miles.
The floor of the centre arch of bridge on Nella-
mungalum road is 2,733·17. Three miles higher up
opposite the village of Sasavegutta the bed of the
river is 2,756·11. One mile above this the Mysore
State Railway to Tumkoor crosses the river where
here is 2 763·65 a level of bridge 2,793

Three and a quarter miles above this bridge we
find the fine bank of Hesargatta. The weir
crest of this bank is 2,804 76. The Chemical
Examiner reports that the water of this bank
is "usable." The distance of this bank from
the Parade Barracks Cistern is 13½ miles. The
catchment basin I find to be 224 square miles
stretching up to the western slopes of Nundydroog
and the hills north of Dod-Ballapur. The upper
tanks in this basin number about 150, above 30 of
these are 100 acres and upwards in extent. The
waterspread of the Hesargatta Tank is estimated
(at weir crest level) to be 407 acres and its extreme
depth 15 feet.

Taking the total rainfall at 36" (an ordinary year)
about 2·7" may be taken as the amount which will
run off and be available for storage This being
only 1-13th of the rainfall would seem a moderate
estimate. The amount available for storage in
an ordinary year will be 1496,000,000 cubic feet.
I estimate that of this 915,000,000 cubic feet will
be absorbed by the upper banks leaving 491,000,000
cubic feet available for Hessargatta Tank and the
river below. Now taking water spread at 400 acres
and average depth 7½ feet, 130,000,000 cubic feet
will be required to fill the tank. As this may possibly
be required for wet cultivation (since ascertained
wet cultivation only 125 acres which at 10,000 cubic
yards per acre will only require 35,000,000 cubic
feet) under the tank it will probably be necessary
to raise the tank weir and bund. If raised 5 feet
the capacity of the tank will be increased to
240,000,000 cubic feet, and thus 110,000,000 cubic
feet will be available for the supply of Bangalore.
To supply 90,000 people with 10 gallons a head,
52,000,000 cubic feet will be required, and even to
supply 150,000 people with the same quantity will
only require 87,000,000. Thus by raising the tank
5 feet there will be more than sufficient for the
supply of the whole population of Bangalore even
if the bank is enlarged to this extent there will
in ordinary years be more than sufficient water to
fill the tank twice. It will be necessary to pump
the water to a height of 3,050 above M. S. L.
that is (from 2,795) a height of 255 feet. . .

Fairly suitable places for a standpipe are to be
found near the tank The best is about 1½ mile
north east of the weir near Gonhalully where the
ground is 86 feet above the weir But this site would
increase the length of mains required, the other
site which is a mile or more nearer Bangalore is 500
yards from the weir near Anvarbandpur, and about
60 feet above it. In this latter case the standpipe
would have to be 200 feet in height, while near
Gondahully it would only be 165 feet. The extra cost
of the standpipe at Anvarbandpur would be more
than counterbalanced by the smaller length of main.
I should mention that the bund of the tank is 1,162
yards in length and the weir 291 feet long. The
present bank of the tank is a substantial one. It is
10 feet above crest weir and 26 feet wide at top.
The inner slope is revetted to within 7 feet of the
top and the outer slope is turfed. The bank is
about 21 feet above the country below. . . .

If the site near Anvarbandpur be selected for
stand pipe the length of the main would be about 18
miles, say 80,000 feet. . . .

I am disposed to agree with General Mullins
that water of a perfectly satisfactory quality can
only be obtained by distillation, but at the same
time I think that that obtained from Hesargatta
Tank will be better than that obtained from most
sources near Bangalore I would recommend that
the Executive Engineer should be called upon to
prepare detailed plans and estimates for a scheme
of water-supply as sketched out in this letter.
The scheme provides for 3 settling beds each
to hold 12 days' supply, a double set of com-
pound condensing engines with pumps The water
will be pumped on to the filters, gravitate thence to
the pure water cistern and be pumped up by the
same engine to the top of the standpipe, the summit
of which will be a balance of 3,000 above M. S. L.
This scheme if carried out on a scale sufficient to
supply the whole of Bangalore would be far less
costly in proportion to the amount of water sent up.
I estimate that 90,000 people could be supplied
with 10 gallons a head at a cost of 25 lakhs, that
is to say that 15 times the quantity of water
could be pumped into Bangalore at a cost of only
4 times the smaller estimate, and that 25 times the
quantity of water could be sent up at a cost of only
8 time the cost. This is owing to the very great
saving there would be on the mains

(for 6,300 people cost	Rs. 5,96,000
90,000	,, 25,20,000
150,000	,, 44,00,000

A 24" pipe would be sufficiently large to pass the
required quantity in the 2nd case and a 42" pipe in
the 3rd case.

The approximate cost for 900,000 gallons daily
supply would be somewhat as follows :—

Settling beds	Rs. 2,50,000
Engine House	,, 20,000
Engine Pump, &c.	,, 1,20,000.
Filters	,, 3,20,000
Pure Water Cistern	,, 1,10,000
Stand pipe	,, 20,000
Mains	,, 12,80,000
Establishment accommodation	,, 10,000
Enclosure	,, 5,000
Improving tank	,, 15,000
Compensation	,, 20,000
Distribution	,, 3,00,000
Service Reservoirs	,, 50,000
Total	Rs. 25,20,000

Hessargatta Tank is the last one formed on the
Arkavati so that however much it is improved, the
interests of people lower down will not be interfered
with to any appreciable extent. After leaving
Hessargatta Tank the River Arkavati has a course
of about 75 miles till it enters the Cauvery 38 miles
below Collegal. Its course runs by Savandroog,
Closepett and Carahally.

Encl 2-92-2

Returned to the Dewan of Mysore, with manuscript copies of Coll. Vibart's Reports of the 20th. October, 11th. Novr./87, and 27th. April/88, taken from printed papers obtained from the Resident's Office, Spare printed copies not being available.

W. H. Wallace

Offg. Secretary to the Govt. of Mysore & W. States.

Bangalore
2nd June/93

Read:— Encl 5 & 6

The following letter from Colonel H. M. Vibart, R.E., Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department, dated Bangalore, 20th October 1887, No. 2946:—

With reference to G.O., of 12th July 1887, No. 1924 W., Public Works, I have the honor to forward an estimate showing approximately the amount of Compensation required to be paid for the removal of Agram and Jakkandra Villages with the hamlets of Venkatapuram and Maistripalya attached to the latter. The Compensation amounts to the large sum of Rs 2,96,843. In addition to this, a sum of Rs 15,000 will be necessary to acquire some other lands besides the above. The total estimated cost will therefore aggregate Rs 3,11,843.—

2. As regards the proposal to take a pipe from the higher level tanks with the view of reduction in the estimated annual Expenditure connected with Captain Donnelly's project A, I beg to point out that

Rs 2

the higher level tank water is required for cultivation and could not be indented on for the supply of the troops. With reference to the idea of pumping from the Cauvery, I beg to point out that the Cauvery at the Railway bridge is some 600 or 700 feet lower than the station of Bangalore, and that, moreover, the water would have to be brought a distance of about 80 miles through a somewhat difficult Country, so that the project indicated is not practically feasible. I propose shortly to visit the Arkavaty river with the view of utilising that river for the supply of Bangalore. The road to Hellamangalam crosses the river at a distance of 12 miles. At this point the catchment basin is about 335 square miles, while lower down, where the road from Bangalore to Ivagada crosses it, the drainage amounts to 575 square miles.

Unfortunately the river is much lower than Bangalore. Probably at the point on Kellamangalam road, 12 miles from Bangalore, it is some 30. feet lower, and if water is obtained from that river, it will have to be pumped up fully 300 feet. Bangalore is situated on the water-shed between the two rivers of Arkavaty and Penaukeny, and these river-beds are about 12 miles distant west and east and some 200 or 300 feet lower. It will be impossible to get water from either of these rivers without Considerable pumping power. I propose shortly to visit these rivers. I enclose a Sketch map showing the position of Bangalore with regard to these rivers with a Sketch Memorandum. ——

Statement Showing the approximate
Agram and Jakkaundra Villages, and the hamlets
latter, for the improvement of Bangalore Water

Villages	Particulars of Land	Dry land					
		Extent		Rate per acre	Amount of Compensation		
		Acres	Guntas	Rs	Rs	as	ps
Agram	Assessed land under Cultivation	275	23	100	27,557	8	"
	Inam land	102	5	200	20,425	"	"
	Waste land fit for Cultivation	70	10	100	7,025	"	"
	Village site unassessed, Gomaul land, tank bed and phoot Karabs	235	25	100	23,562	8	"
	Total	"	"	"	"	"	"
Jakkaundra and the hamlets of Venkatapuram and Muneshwara attached to it	Assessed land under Cultivation	391	30	100	39,175	"	"
	Inam land	207	5	200	41,425	"	"
	Waste land fit for Cultivation	11	15	100	1,137	8	"
	Village site, unassessed, Gomaul land, tank bed, and phoot Karabs	73	21	100	7,352	8	"
	Total	"	"	"	"	"	"
	Grand Total	"	"	"	"	"	"

N.B. – For the enlargement of Agram tank some oth
yellakunta and Boomanally, which are not inc
of tank bed and the Compensation of which with

Bangalore,
20th September 1887

estimated for the purpose of taking and Mastupalya attached to the the Agrau Halli, Bangalore taluk. —

Land Ex acre of Compensation					Rate for acre	Amount of valuation	Total compensation estimated. —			Amount of 30 years' Cowlagam due to Government. —			Amount of Compensation for the tank. —	Houses, temples, and other buildings in the village etc. —	Bungalow, temples and grants &c. —	Amount of Wells. —	Total amount of compensation estimated —
Ac	Rs				Rs	Rs	Rs	a	p	Rs	a	p	Rs	Rs	Rs	Rs	Rs
150	11,850	-	-	7	200	1505	40,912	8	-	23,720	12	-	20,000	15,000	1,020	4,575	1,65,267
250	9,056	"	"	"	"	"	29,481	4	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	7,025	"	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	23,582	8	-	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	1,00,981	4	"	"	"	"	"	"	"	"	1,65,267
150	1,773		18	28	200	2140	43,088	12	"	15,813	"	"	2,500	10,243	1,230	4,940	1,31,576
250	231		12	2	00	361	45,271	4	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	1,137	8	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	7,352	8	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	96,850	"	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2,96,843

attached to the villages of Venkajee Rayanakaroy Karalorkund in the above, are necessarily required for the purpose nearly Rs 15,000. —

(Sd) A. S Macintire,
Deputy Commissioner.

Memorandum

Bangalore is on very high ground between the valleys of the Arkavuty & Penankeny rivers and it can only be supplied with a copious supply of water from either one or other of these rivers About 15 miles to the east we find the very large tank of Ooscottah on the valley of the Penankeny This tank might be made available, but the water will have to be pumped up a height of 200 feet. To the west we have the Arkavuty on the road to Nagadi; the Arkavuty is crossed at a distance of 19 miles from Bangalore, but the bed is some 350 or 400 feet lower than the city.

On the road to Nellamangalam about 12 miles from Bangalore, the Arkavuty is crossed; here it is only about 220 feet below Bangalore. At this point the catchment basin of the Arkavuty is about 335 Square miles, while the catchment basin of the Ooscottah tank is 650 Square miles On the road to Nagadi, at

at a distance of 6 miles, a small drainage of 4 Square miles is crossed, which is said to have a good deal of water, but I do not think it at all likely there will be found to be sufficient there. The heads of this drainage I do not know. About half way to Bascattah and 2 miles to the left of the road is a drainage of about 65 Square miles with a terminal tank which was Constructed at the time of the last famine. This might be utilised but the drainage area is not, I think, sufficiently great. General Gullins states that the water of the Bascattah tank is not considered good by the natives, but I think it would be worth while to have the water analysed, and, if found good, this water might be pumped up to Bangalore. There is a hill close to the tank, height 2,887, and on this hill might be erected a stand-pipe

do as to command the barracks at Bangalore, but the Stand-pipe would have to be 143 feet in height. I propose to use Shoolay Cocottah tank, the river Arkavaty on the road to Hellamangalam, and the other two smaller drainages mentioned in this memorandum.

Bangalore. 20th October 1887. (Sd) H. M. Vibart Colonel. Superintending Engr. V. Circle

Order:- dated 5th November 1887, No. 2940 W., Public Works.

Ordered that forwarded to the Government of India.——

Letter:—— to the Secretary to the Government of India, Military Department dated 5th November 1887, No. 2941 W.——

Adverting to your letter, No. 1182 M. W., dated 11th June 1887, on the subject of the Bangalore water-supply, I am directed to forward Copy of the accompanying letter, with enclosures, from the the Superintending Engineer,

ngineer V Circle, affording the information called for by the Government of India in respect to the Cost of removal of the four Villages which drain into the Agram Tank, and offering remarks as to the other suggestions Contained in paragraphs 4 and 5 of your letter under acknowledgment.

2. I am to add, that the question of Supplying the troops with pure drinking Water is still engaging the attention of this Government, as will be seen by their Proceedings, No. 2810 W., dated 20th October 1887, Copy of which I am to forward for the information of the Government of India.—

(True Extract)

To F. C. Hunter Esq. C.E.
Secretary to Govt. P.W.D.

15.— This scheme if carried out on a scale sufficient to supply the whole of Bangalore would be far less costly in proportion to the amount of water sent up.—

I estimate that 90,000 people could be supplied with 10 gallons a head at a cost of something like 25 lacs, that is to say that 15 times the quantity of water could be pumped into Bangalore at a cost of only 4 times the smaller estimate and that 25 times the quantity water could be sent up at a cost of only 8 times the cost. This is owing to the very great saving there would be on the mains.—

A 24 in: pipe would be sufficiently large to pass the required quantity in the first case, and a 42 in: pipe would be sufficient in the second case.—

16.— The approximate cost for 900,000 gallons daily supply would be somewhat as follows:—

	Rs.
Settling beds	2 50,000
Engine House	20,000
Engine pump &c.	120,000
Filters	320,000
Pure water cistern	110,000
Stand pipe	20,000
Mains	1,280,000
Establishment Accommodation	10,000
Enclosure	5,000
Improving Tank	1/4 of all
Compensation	
Distribution	300, city
Service Reservoirs	50 the
	2,520, are

To supply 150,000 people water, 10 a day would probably not cost more than 44 Lacs.—

17.— Nesargatta Sank is the last one formed on the Arkavati, so that however much it is improved, the interests of people lower down will not be interfered with to any appreciable extent —

After leaving Nesargatta Sank, the river Arkavati has a course of about 75 miles till it enters the Cauvery at 38 miles below Collegal. Its course runs by Savandroog, Closapett and Caneankally.—

I have &c.

(Signed) Henry M. Vibart Coll. R.E.

Superintending Engineer

The water from this tank would have to be pumped up 220 feet and it would have to be carried some 8 or 9 miles. The catchment basin of this tank is only abou 1/5th of Ooscottah Tank, so it would be more likely to fail than that tank in bad seasons, but as the Ooscottah Tank is only 3 miles distant in a direct line and 22 feet higher, the supply might when required be supplemented from that tank should the water be reported on favorably. —

22. — Now with regard to the flooring with concrete a space on high ground commanding the station. The best place for this would be the ground now used as a Polo ground which is the highest ground in Bangalore. I think in estimating the cost of this the lowest Annual rain fall should be taken. Looking back we find that from November 1874 to September 187, there was very light rain (that is for 32 months)

In 1875. 18·425 inches 62 Rainy days
" 1876. 17·175 — " — 57 — do —

In the calculation sent with G.O.D. 18th July 1887, No. 1924 W, the rainfall is taken at 32·82. The lowest rainfall is but little more than half this quantity hence it will be necessary to double the

area

area to be laid down with concrete. This will require 25 acres in place of 15. In the estimate the thickness of concrete necessary is taken at only 6" Surely this would be insufficient. It would, I think be found necessary to have the concrete at least 1 foot thick. This increase in thickness of concrete and in area of ground would add about Rupees 75,000 to the estimate.

It is still intended to supply 50,000 gallons from the Albion Tank, and this being the case, it would seem probable that Captain Romilly's proposals regarding the improvement of that tank would have to be carried out; and it would appear from this that the proposal to supply pure drinking water by flooring a large area with concrete as a gathering ground, would not be economical, and although the water would be fairly good it can I think hardly be supposed that the water would be as good as that supplied by the Condensers.—

23.— In conclusion I would strongly recommend that my proposal to supply Bungalore from the Arkavati at Sasavegatta may be investigated, and if that scheme should be found to sufficiently economical that water should be pumped from the Hesaraballe Tank. I think the former

economical

13. — It was proposed to pump water from the Nigrain Tank 3 Miles South-east of the Nigrain Entrenchment. It is considered that this would not be a great improvement on the present supply and it is doubtful if in bad years the supply available would be sufficient as the catchment area of the tank is but small. The total drainage amounts to 32 sqre Miles but in this there are about 25 tanks, 5 of which appear to be of considerable size quite as large as Nigrain Tank itself. —

The scheme would moreover be far from cheap as a very large sum would have to be paid for compensation, Rupees 3,12,000. Bringing the total cost to Rs. 6,02,000 while the Annual expenses would be Rs. 44,035.

14. — Another proposal was to con-dense drinking water for the troops (9000 gallons daily) while the remainder of the supply about 50,000 gallons was to be pumped up from the Gibson Tank and Shoby's Wells. The cost of this was estimated at Rs. 167,000, while the annual outlay would have been as much as

Rs. 84000 the cost of guard for Conn
being Rs. 43200
15.— It now remains to be seen what
source can be utilized if we go further
away from Bangalore.——
16.— I think that the Arkavati River
to the west of Bangalore would do well.
At first I supposed that a point on
the Magadi Road some 18 miles dis-
tant would be a suitable place where
a bank might be thrown across the
river and water thus stored drawn off
into settling beds and then pumped up
to Bangalore. The locality is it is believed
suitable for a bund and the drainage
basin of the river at this point is between
500 and 600 square miles, but the bed
of the river is some 350 to 400 feet lower
than Bangalore so it would have to be
pumped up in two lifts and the project
would be costly.—
17.— On the road to Nallamangalam
the same river is crossed some 12 miles
from Bangalore and at this point the drain-
age amounts to some 335 sqre. miles. I
have examined this river for several
miles above this point and I think a
suitable position for a bank across this

south of the railway bridge over the Arkavati (11½ miles on Mysore State Railway in direction of Tumkur.)—

18.— I intend to have levels taken of this river shortly, and propose to employ Supervisor Sergt. Green on this work. The water from this river will have to be pumped up fully 200 feet. Not far off to the East are some hills (rising to 3,108) which would be available on which to place a stand pipe. The distance of Sasavegatta (where the bund is proposed) to Subedars' Chattram in a direct line is about 7 miles.

19.— Six or Seven miles out on the Magadi Road there is a small drainage which is said to have a good supply of water, but the extent of country drained is very small (not more than 5 sqre. miles) and would I consider prove quite inadequate in the hot weather. On the road to Kingeri this same drainage is crossed at a distance of 7 miles from Bangalore, but this is 4 miles further down the stream and here, though the drainage is a good deal larger the stream is very much lower as the road from Bangalore to this point fall's steadily all the way.—

20.— Turning to the East of Bangalore we have the Vrishabhavathy Valley which at 15 miles from Bangalore is crossed

up forming the Doscottah Large
This is a splendid tanks. —

(Drainage area, 540 sqre miles.
Water spread at F.T.L. 3100 acres
nearly 5 sqre miles.
Capacity 810 Millions cft
F. T. L. is 2831 + M. S. L.

The Water from this tank would have to be pumped up 200 ft and carried 15 miles.

General Mullins states that the natives do not consides the water of this tank good, but this requires investigation. I have already sent some water from this tank to the Chemical Examiner at Madras for analysis. Besides this I have sent specimens of waters from 2 other tanks (Doscottah Chickkere Tank and Heranhalli Tank) as well as specimens from the Arkavati River. —

The Doscottah Chickkere water is said by the natives to be better than that of Doscottah Large tank. The catchment basin of the small tank is however only some 61 sqre miles. The tank is some 12 feet higher.

21. — Some 4 miles nearer to Bangalore than Doscottah Tank, we find another fine tank, which has a large water spread extending across the road to Madras. It is called Heranhalli or Yella Mallappa Chetty's Tank.

(Drainage area 11 square miles.
Water spread at F. T. L. 276 acres
Capacity 70,000,000 cubic feet
F. T. L. is 2,209 + M. S. L.

and will not retain the water which passes into it. Every advantage has thus been taken of the high ground in the immediate neighbourhood of Bangalore to collect rain water in tanks on the highest possible level and I am of opinion that that source of supply has been completely exhausted.

6.— The source from which the British Troops have been supplied for the last 23 or 24 years is the Ulsoor Tank. It has been considered that this supply is not sufficiently pure. If certain proposals are carried out, it is clear that the water would be greatly improved and perhaps prove sufficiently good.

7.— These Improvements are:—

1st:— To entirely divert the drainage of the Cantonment bazaars so that none of it will enter the tank.—

2nd:— To obtain a purer supply from the east of the tank to be substituted for that cut off.—

3rd:— To provide a filter above the discharge sluice of the upper Ulsoor Tank, so that the waters from the Ulsoor Tanks may be cleansed before it is allowed to pass into the lower.—

4th:— To fence the Ulsoor tank so that no one could obtain access to it.—

5th. To build 4 large wells
of the Ulsoor Tank to supply the
population without their having any
means of drawing water from the
Tank itself. —
6th. To cover the whole surface of the
Tank with Singara or other useful
aquatic plants to cleanse the water.
7th. To increase the filtering power
at the Dhoby's wells. —
8th. To cover the R. H. Artillery and
Cavalry Cisterns (this ought to be
done in any case.)
9th. Renewing filtering material
more frequently. —

Also to prevent drainage from tanneries and burial ground entering the tank. —

These works are estimated to cost 1,33,000 Rupees while the annual expenses are set down at 27,000 Rupees. —

3. — The Reservoir on the Jumkur Road is on a high level, the waste weir being 104 feet above that of Ulsoor Tank and 40 feet above that of No. 1 in the Miller series. —

It does not unfortunately answer expectations. Drainage area is insufficient in extent and cannot be extended except

t a prohibitive cost and then only by a very small amount. In addition this the ground is remarkably absorbent The bed of the tanks allows the water to a large extent to pass under the bund and thus it is impossible to keep in the tank a sufficient supply through the hot weather, even if there has been a copious monsoon.

9.— It is possible that the ground might be made to yield a better supply by burning the grass in the dry weather and this should be done although it is by no means certain that it would be as effective as supposed. The tank is believed to be rather more water tight than it was a few years ago but the process setting up which is of course going on is slow and it is unlikely that the bed will be impervious to water for many a long year. If the bottom of the tank was covered with good clay, it might have the desired effect but this remedy would be very expensive and I fancy prohibitive in consequence. The water spread of the tank is 300 000 ~~Square~~ yards; and would probably cost 3 lacs of rupees as the stuff would have to be brought a long way.— ~~Cubic~~ to cover this to the depth of a yard would take 300 000 cubic yards

10.— It was supposed that water for the supply of Bangalore might be brought from the neighbourhood of Budadrug and there is no doubt that this could be done, for to the

west of that hill there is an
miles which has sufficient
this could be supplemented by a more
to the east of the hill. The Mailcottah Tank
it was considered could be improved so
as to store sufficient water. This subject
deserves some consideration. —

There is no doubt that the troops could be supplied from this source but there is no less certainty that the scheme would be expensive for the water would have to be brought 30 miles and the mains alone would cost some 6 or 7 lacs of Rupees. —

11. — This scheme seems to me to give the best and indeed the only hope of bringing more water for the troops to Bangalore by gravitation. —

The question remains is the rainfall so certain that 12 sq^re miles can be depended on. In bad years I should say certainly not. In 1875 there was only 18.425 inches of rain at Bangalore with 62 rainy days, while in 1876 the following year there was only 17.715 in 57 days. The fall at Nandidroog is however probably heavier than at Bangalore. I have no statistics on this point. —

12. — Failing this scheme there would seem to be no alternative but a resort to pumping, which cannot of course ever be

No 3233

Superintending Engineer's Office.
V Circle, Madras.
Chepauk, 11th November 1874

From,

Colonel A. McC. Gibbon, R.E.,
Superintending Engineer
V. Circle.

To,

The Chief Engineer
P.W. Department.

Sir,

I have the honor to forward the following remarks regarding the Water Supply for the British Troops at Bangalore which may prove of use in enabling the Government to arrive at a decision. ——

2.— The reason that it is so difficult to supply Bangalore with a copious supply of pure water is that Bangalore lies on the water shed between the River Arkavati on the west, and the Pinakany on the east, and that there is a very small extent of ground outside Bangalore (in the neighbourhood) high enough to be made use of for gathering grounds. To the south, east and west the country falls rapidly away from Bangalore and a very short distance to the north the ground is too low

to be of any avail (with the exception of a few isolated hills of small extent) until we reach the neighbourhood of Nundidroog some 30 miles distant.—

3.— The Military Cantonment lies on a ridge between the Bederhally Valley the drainage of which passes into the Ulsoor Tank) and the valley which lies to the South of the Brigade ground the tank lying at the head of this valley being the Dharmanbody which supplies the Pettah. The Cantonment Bazaars lie in the valley of the west feeder of the Ulsoor Tank at the head of which is Miller's Tank. This Tank was constructed in 1854. It was the first improvement made to meet the wants of the growing station. It was not till 1859 that the subject of water supply attracted much attention in connection with the new barracks on the old race course.—

It was then first proposed that the waters of the Ulsoor Tank should be utilized to supply the Troops and although it was objected to that as this tank receives the drainage from a large portion of the Cantonment the waters of it must be

rendered unfit for use; still the works were carried out. It was considered that the objections on the score of dirt might be largely obviated by increasing the capacity of Miller's Tank and constructing a sewer to carry the drainage of the Cantonment Bazaars under the tank and so prevent its contaminating the Ulsoor Tank water. The Tank was enlarged in 1863 and the sewer completed in 1864. In 1864 also the Railway Reservoir was built below Miller's Tank, and in 1866 another was built above Miller's Tank, while in 1867 a fourth reservoir was built.—

4.— It will thus be seen that in this valley the principle laid down and acted on was to fix the impounding reservoir so at the highest possible point, and this has been acted on since in several minor works, and then and since much has been done to improve the Sarjapoor, Shoolay and Ulsoor Tanks, the last two especially greatly improved by the construction of the upper Ulsoor tank. It was to construct a tank in the Bedar valley from which much good rich soil was obtained, but it was found that

would only admit of a small reservoir and that evaporation would be very great It was also stated that population would spread up in time and more or less pollute the supply so the idea was abandoned. —

It was stated that a series of small reservoirs in this valley similar to those at the upper end of the Cantonment valley would be useful in raising the spring level and might be designed to flush the sewer "which must at some future day be construcded to cut off the impurities of the growing town from the Ulsoor Tank." —

5. — The last endeavour to carry out the principle of impounding water on the highest level was the construction of the reservoir at a dip of the Jumkur Road 2½ miles beyond "High Ground" S. W. and close under Muntapam hill, the gathering ground lying round Muntapam hill and Subadar's Chattrum. Had this tank answered the expectation formed of it, the vexed question of the supply of Bangalore would have been settled, and unfortunately the drainage area is extensive enough and moreover the tank is not watertight

Bank is a substantial one. It is 10 feet above crest weir and 26 feet wide at top. The inner slope is revetted to within 7 feet of the top and the outer slope is turfed. The bank is about 21 feet above the country below. —

9.— Give below an approximate estimate of the cost of the schemes for the supply of the British Troops, basing the estimate on the requirements shown to be necessary by the late Captain Romilly in his report regarding General Mullins's scheme of supply from Sogram Bank. —

	Rs.
Three Settling beds &c.	16,000
Engine house	10,000
Double set of 40 horse power Engines	48,000
Filters	20,000
Pure water Cisterns	7,000
Stand Pipe	12,0
Mains (12 in. pipes and $\frac{3}{8}$ in. thick)	420,00
Accommodation for establishment	10,000
Enclosure wall	4,00
Service Reservoirs	10 00
	557,00
Improvements to Bank	9,00
Compensation	30,0
	596,000

10.— If site near Nowabandpur be selected for stand pipe the length of main would be about 15 miles say 80,000 feet taking a 12 inch pipe ($\frac{5}{8}$ in. thick) which will

a mean of 50 feet, the weight of piping will be 3,000 tons.—

11.— As soon as the new waters works are completed the pumping machinery at Ulsoor Rock and Shoby wells can be sold, and will fetch a good deal. The one at Shoby wells is not old and the other one though older is in good order and does the work required of it well.—

12.— I am disposed to agree with General Mullins that water of a perfectly satisfactory quantity can only be obtained by distillation but at the same time, I think that, that obtainable from Hesargatta Tank will be better than that obtained from most sources near Bangalore.—

13.— I would recommend that the Executive Engineer should be called upon to prepare detailed plans and estimates for a scheme of water supply as sketched out in this letter.

14.— The scheme provides for 3 settling beds each to hold 12 days supply; A double set of compound condensing engines with pumps. The water will be pumped on to the filter, gravitate thence to the pure water cistern and be pumped up by same engine to the top of the stand pipe, the summit of which will be at a level of 3050 feet above M.S.L.—

seem a moderate estimate.—

The amount available for storage in an ordinary year will be 1,406,000,000 cubic feet.—

I estimate that of this 915,000,000 cubic feet will be absorbed by the upper Tanks leaving 491,000,000 of cubic feet available for Hesargatta Tank and the river below.—

Now taking water spread at 400 acres and average depth 4½ feet 130,000,000 cubic feet will be required to fill the Tank. As this may possibly be required for wet cultivation (since ascertained, wet cultivation only 128 acres which at 10,000 cubic yards per acre will only require 35,000,000 cubic feet) under the tank, it will probably be necessary to raise the tank weir and bund. If raised 5 feet the capacity of the Tank will be increased to 240,000,000 cubic feet and thus 110,000,000 cubic feet will be available for the supply of Bangalore. To supply 90,000 people with 10 gallons a head 52,000,000 cubic feet will be required and even to supply 150,000 with the same quantity will only require 87,000,000.

Thus by raising the Tank 5 feet there will be more than sufficient for the supply of the whole population of Bangalore

Even if the Tank is enlarged this extra water will in ordinary years, be

sufficient water to fill the tank twice
5.— It will be necessary to pump the water
to a height of 3050 above M.S.L. that is
(from 2795) a height of 255 feet.—
6. The supply required for the British Troops
alone has been estimated at 60,000 gallons
a day and it will be necessary to pump
sufficient for 3 days during a working day
of 8 hours, that is 180,000 gallons equivalent
to 370 gallons a minute. An engine of 40
horse power will be sufficiently powerful to
effect this.—
7.— Fairly suitable places for a standpipe
are to be found near the tank. The best
is about 1¼ miles North East of the weir
near Gondahalli where the ground is 86
feet above the weir, but this site would
increase the length of mains required;
the other site which is about a mile or more
nearer Bangalore is 500 yards from the weir
near Sivarampur and about 50 feet
above it. In this latter case the stand pipe
would have to be 200 feet in height, while
near Gondahalli it would only be 165 feet.
The extra cost of the stand pipe at Sivar
Sandpur, would be more than counter-
balanced by the smaller length of main
:— I should mention that the bund of
the Tank is 1162 yards in length and the
weir 2 et long. The present bank of the

No. 377

Superintending Engineer's Off.
V Circle
Bangalore 27th April 188

From,
Colonel H. M. Vibart, R.E.,
Superintending Engineer
V. Circle.

To,
The Chief Engineer
P. W. Department.

Sir,

In continuation of my letter No. 233 dated 11th November 1887, I have the honor to state that I have had levels taken to ascertain the height of the Doscottah and Heranhalli tanks.—

1st. With regard to the Doscottah tank:—
F. T. L. is 2836·54 above M. S. L. Drainage area about 540 sqre. miles. Water spread of tank at F. T. L. 3,100 acres. Capacity 810 000, 000 cubic feet. Distance from Parade Barracks Cistern in a direct line about 12 miles. The Chemical Examiner reports the waters of this tank to be "suspicious"

2nd. With reference to Heranhalli tank:—
F T L is 2838·82 above M. S. L. & area 111 square miles. Water spread of 276 acres Capacity 70,000,000 cub Distance from Parade Barracs in a direct line, about 9 miles The Chemical Examiner characterises waters also as suspicious."—

3— In addition to the above

levels taken along the Arka.
the point where the road from Bangalore to Nallamangalam crosses it, up the river for a distance of over 7 miles. —

The floor of the centre arch of bridge on Nallamangalam road is 2733·17. Three miles higher up opposite the village of Sasave-=gatta the bed of river is 2756·11. One mile above this the Mysore State Railway to Shimkus crosses the river, which here is 2763·65. (Rail level on Bridge 2793.) Three and a quarter miles above this bridge we find the fine Tank of Nesargatta. The weir crest of this Tank is 2804·76. The Chemical Examiner reports that the water of this Tank is "Usable." The distance of this tank from the Parade Barracks Cistern is 13½ miles. The catchment basin I find to be 224 sqre miles stretching up to the western slopes of Nandidroog and the hills north of Doddballapur. The upper Tanks in this basin number about 150, about 30 of these are 100 acres and upwards in extent. The water spread of the Nesargatta Tank (estimated (at weir crest level) to be 1½ miles and its extreme depth 15 feet. Rainfall Taking the total rainfall at 36 inches (balance any year) about 2·7 inches may be — I set as the amount which will run into the Tanks available for storage. —

over 2 in

Thus

would be by far best of the two,
the latter would be superior to the Algram
Sank Rehame and less expensive as
very little would have to be paid for
compensation.—
24.— I am convinced that if a
thoroughly good and copious supply
is required in bad seasons it must
be pumped up some 200 feet.—
25— As soon as I receive the analyses
of the water which I have sent to the
Chemical Examiner I will forward them
to you.—

Yours &c
/Signed/ Henry M. Vibart Coll. C.E.
Supt. Engineer.